REMARKS

This amendment after final rejection is submitted pursuant to 37 CFR 1.116 because Applicants believe that all claims now presented are in condition for allowance. In any event entry of this amendment will place this application in better form for appeal. No new matter has been added and no new issues have been raised. Finally the arguments presented herein are in direct response to points raised by the Examiner in the last office action and Applicants could not have filed their response at an earlier date.

Applicants have combined claims 17 and 20 into amended claim 17, and combined claims 31 and 35 into amended claim 31. Thus claims 20 and 35 have been canceled. Applicants have amended all claims to refer to the cryogenic solid propellant as a monergole solid propellant so that there is no doubt that Applicants are claiming a single component fuel substance as set forth on page 2, lines 20 and 21 of the application. Thus claims 17 through 19, 21 through 34, and 36 through 42 remain in the application, and are again presented for examination.

Applicants believe that there are significant difference between their monergole compositions and the methods to prepare these compositions and anything disclosed in either the REYNOLDS reference, the GROSSE et al reference, or the combination of these references. Now that Applicants have combined claims 17 and 20, and combined claims 31 and 35, to require that the monergole

cryogenic solid propellant, comprising a solid phase structure, having hollow spaces, is an open pore foam, the disclosure in REYNOLDS is now clearly distinguished. In col. 1, lines 44 to 63 of the reference, it is clearly indicated that the explosive, propellant or blasting compositions disclosed therein, include as an essential element, a metal sponge of a combustible material, such as aluminum or magnesium. By the term "metal sponge" REYNOLDS expressly indicates that what is meant is a rigid metal matrix, which contains distributed throughout its inner portion, in a generally uniform manner, a multiplicity of discrete interconnecting cells or pores, which communicate with each other. REYNOLDS expressly states in col. 1, lines 56 to 59: "This material [metal sponge] is to be differentiated from metal foams in which the pores or cells are closed and do not interconnect or communicate."

Now that Applicants have limited their independent claims 17 and 31 to require that the solid phase structure comprising part of the monergole must be an open pore foam, not only is the disclosure in REYNOLDS clearly distinguishable from the present invention, but furthermore since REYNOLDS goes on to specifically differentiate the metal sponges from metal foams, which by definition as foams, cannot be a rigid, metal matrix as defined in the reference. Thus the solid phase structure of REYNOLDS is distinguished from the presently claimed solid phase in the cryogenic solid monergole.

REYNOLDS refers to a compound of explosives consisting of an aluminum sponge, with liquid oxygen being filled into the pores of the aluminum sponge. The sponge filled with liquid oxygen is enclosed in a suitable case of thin metallic sheet or in a tube which is closed at both ends; see col. 2, lines 26 to 29 of the reference. Explosives and rocket propellants differ from each other significantly. It is essential for the explosives that the reactive power is released completely by an explosion taking place in a very short period of time. In rocket propellants the reactive power is released over a long period (i.e. the reaction is deliberately controlled in order to generate optimal thrust over the time profile). Furthermore generally explosives are not meant for rocket propulsion.

Nor does combining REYNOLDS with GROSSE et al provide any basis for the argument that the presently claimed invention is obvious. The GROSSE et al patent is based upon hypergolic (i.e. self-igniting oxidizer and fuel)propellant grains for rocket propulsion use. The self-ignition is inhibited by providing very thin layers (e.g. thin layers made from polyethylene)between fuel and oxidizer (see col. 12, lines 40 to 42, or col. 6, lines 13 through 27. According to GROSSE et al, fuel elements and oxidizer elements are arranged in a regular manner (see col. 11, line 73 through col. 12, line 5).

Applicants' presently claimed invention refers to propellant grains based upon monergole and not upon hypergolic propellant grains as in GROSSE et al. Therefore the presently

claimed cryogenic solid monergole propellants avoids completely any kind of inhibitor layer between fuel and oxidizer. The stable condition of fuel and oxidizer according to the presently claimed invention, is established by cooling only. Oxidizer and fuel are not separated as in GROSSE et al. In fact Applicants even recommend the direct contact of fuel and oxidizer so as to ensure a stable combustion.

Besides the differences already pointed out between the invention in GROSSE et al and the invention as presently claimed , neither the fuel nor the oxidizer elements require any kind of geometric shape according to the present invention. Therefore the present invention, as disclosed and claimed, requires no shape forming techniques such as molding or pressing of the fuel and oxidizer elements. See col. 5, lines 57 to 63 of GROSSE et al.

The presently claimed invention employs an open pore fuel foam or open pore oxidizer foam, respectively with an amorphous distribution of pores, into which the oxidizer or fuel is respectively filled. Furthermore Applicants' invention is not restricted to the proportion of fuel and oxidizer elements, as given in GROSSE et al, ranging from 0.1 to 50 mm; see col. 14, lines 2 to 7. The pore walls of the foam described by the Applicants are significantly thinner than the minimum dimension of 0.1 mm defined by GROSSE et al.

In view of the abovementioned differences between the presently claimed invention and the disclosures in each of REYNOLDS and GROSSE et al, no combination of these two references will lead

to the presently claimed invention. Applicants especially wish to emphasize that the GROSSE et al reference discloses inhibitor layers between oxidizer and fuel, thereby precluding monergole formation. For this latter reason alone, the simple combination of REYNOLDS and GROSSE et al will not lead one "skilled in the art" to the presently claimed invention where cryogenic solid monergole propellants are prepared. Thus no combination of these references provides any basis to reject any claim now presented as obvious under 35 USC 103.

Nor does combining REYNOLDS and GROSSE et al with STICKLER provide any basis to reject any claim now presented as obvious under 35 USC 103. STICKLER discloses a heterogeneous solid fuel material comprising at least one combustible component defining a continuous solid polymeric matrix substantially free of oxidizer and, dispersed therein, at least one particular component. STICKLER does not disclose a foam material for storage of a solidified cryogenic oxidizer. Furthermore STICKLER does not disclose a frozen liquid within a solid fuel matrix.

Once again freezing of a liquid dispersion leads to changes in the volume of a matrix. One skilled in the art would expect such a propellant to lose its homogeneity and combustion properties. However, such is not the case according to the presently claimed invention.

The KEILBACH propellants are liquid slurries, such as liquid oxidizer metals, liquid oxygen, and liquid hydrogen. No cryogenic components are disclosed in KEILBACH et al. This

reference deals exclusively with liquid propellants and neither discloses nor suggests any information that would enable those "skilled in the art" to deal with cryogenic solid propellants. Thus no combination of the REYNOLDS and GROSSE et al references with KEILBACH provides any basis to reject any claim now presented as obvious under 35 USC 103.

The Examiner has rejected claims 18 and 32, last presented, as obvious under 35 USC 103 citing the combination of REYNOLDS, GROSSE et al and KRIVOHLAVEK. The latter reference refers to a multi-phase emulsion, which can be used as an explosive, but not as a rocket propellant. Since the explosive is a liquid or a gel (see col. 2, lines 33 to 46), application of this composition as a rocket propellant must be entirely excluded. Feeding the liquid multi-phase emulsion into the combustion chamber by pumps would lead to its degradation. Thus one "skilled in the art" would not use the KRIVOHLAVEK composition as a rocket fuel. Thus why would one "skilled in the art" combine the KRIVOHLAVEK composition, a composition not suitable as a rocket fuel, with the GROSSE et al composition to arrive at the present invention, especially since GROSSE et al discloses hypergolic solid propellants and not cryogenic solid monergoles. Just because KRIVOHLAVEK refers to explosives in terms of emulsions, does not mean that emulsions of cryogenic monergoles can be considered as rocket propellants at all. In any case, the GROSSE et al process requires that the hypergolic oxidizer remain separated from the fuel through the use of inhibiting layers. Therefore the

combination of KRIVOHLAVEK together with GROSSE et al or GROSSE et al and REYNOLDS still would not lead one "skilled in the art" to the presently claimed invention.

In the paragraph bridging pp 4 and 5 of the office action, the Examiner questions how the Applicants can avoid shrink hole formation whereas GROSSE et al cannot. Applicants point out that the matter of shrink hole formation is not relevant to the GROSSE et al invention, since there are no pores filled with a liquid oxidizer, but instead with a hypergolic oxidizer and fuel elements of determined geometric shapes are manufactured by shape-forming techniques such as pressing.

In summary neither the combination of REYNOLDS and GROSSE et al, nor the combination of REYNOLDS, GROSSE et al, and STICKLER, nor the combination of REYNOLDS, GROSSE et al, and KEILBACH et al, nor the combination of REYNOLDS, GROSSE et al, and KRIVOHLAVEK, provides any basis to reject any claim now presented as obvious under 35 USC 103. The GROSSE et al patent discloses a hypergolic cryogenic propellant with a well-defined geometric shape and a separation layer that inhibits the reaction between oxidizer and fuel. In contrast the present invention includes a cryogenic monergole propellant, where oxidizer and fuel are in direct contact.

The REYNOLDS and KRIVOHLAVEK references refer to explosives and not to rocket propellants. Explosives and rocket propellants cannot be considered as simply interchangeable. Due to their incomparable fields of application, the combination of GROSSE

et al, REYNOLDS and KRIVOHLAVEK would not lead those "skilled in the art" to the presently claimed invention.

Furthermore even if one "skilled in the art" did combine these three references, one would have to perform significant modifications in the inventions as disclosed in REYNOLDS and KRIVOHLAVEK. Namely one "skilled in the art" would have to change the explosives disclosed in these references to monergole rocket propellants, and to leave out the separation layer called for by GROSSE et al. In addition the skilled worker would have to replace hypergolic propellants with monergoles. Thus the combination of these three references will not lead to the presently claimed invention. The reasons why the presently claimed invention distinguishes over the combination of the REYNOLDS and GROSSE et al references with the STICKLER and with the KEILBACH et al references have already been discussed.

Applicants believe that all claims now presented are allowable over the cited prior art, and a response to that effect is earnestly solicited.

Respectfully submitted,
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